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AN INDEX CHART BASED ON PRICES AND MONEY RATES

WARREN M. PERSONS

IN the analysis of statistical series for the construction of "An Index of General Business Conditions," presented in the REVIEW for April, 1919, it was found that 20 series of monthly items could be classified into 5 groups.[1] The classification of the series into these groups was with reference to the sequence in time of their cyclical fluctuations during periods of prosperity and depression for the period 1903–14. It was found: that major fluctuations in the prices of securities preceded by two to four months similar fluctuations in the volume of speculative transactions; that major fluctuations of the volume of speculative transactions preceded by two to four months similar fluctuations in the group comprised of series measuring the physical volume of production and the aggregate value of goods traded; that the fluctuations of the last named group in turn preceded by two to four months similar fluctuations in commodity prices; and that fluctuations in commodity prices preceded by four to six months similar fluctuations in the group comprising rates on commercial paper and New York City bank loans and deposits.

In the same analysis, also, a threefold grouping of series was made with reference to the time relationship of their cyclical movements during 1903–14. Group A consisted of series indicating (1) the prices of securities and (2) the volume of speculation; Group B consisted of series indicating (1) the prices of commodities and (2) the volume of production and business transactions; and Group C consisted of series indicating (1) the rate of interest on commercial paper and (2) the volume of credit extended as shown by loans and deposits of New York banks. The current Index Chart of the Harvard Economic Service is based upon the threefold grouping just described. The threefold instead of the fivefold grouping was adopted for current use because, first, the significance of certain series, such as loans of New York banks and the prices of railroad stocks, had changed and consequently, we were obliged to discard them and, second, the pre-war sequence had been interrupted by the war and it appeared probable that the restoration of the sequence, when it occurred, would be first revealed by the less refined grouping.

When the current Index Chart was set up in the spring of 1919 we appreciated that in its construction we were not utilizing certain important facts established by our original analysis. Thus the analysis indicated that, following a period of business depression, the physical volume of production and the aggregate value of goods traded (Group III) regularly revived some months previous to a recovery in commodity prices [2] whereas, following a period of prosperity, declines in production and prices were almost simultaneous. The facts just stated and others of a similar nature were not used in the current Index Chart. The time has come, however, when it seems profitable to investigate some of these neglected points with the object of improving our index of general business conditions. One obvious line of investigation is to select statistical series, or possibly to construct new series showing, first, the *prices* of securities, of commodities, and of credit and, second, the *volume* of speculation, of manufacture, and of loans. Having secured reliable data for these six important factors in the business situation the next step is to ascertain their relations to each other. It is the purpose of this article to present and compare series for stock prices, commodity prices, and money rates.

THE PERIOD 1920–21

Chart 1*a* is the current Index Chart made up of three curves based upon groups of statistical series connected with speculation, business, and banking, respectively. The base line for each of the constituent series of each group was determined in the spring of 1919 on the assumption that business activity and commodity prices had reached points of maxima in 1918 and that the base line should, therefore, be relatively as much below such points as the base line in previous periods of activity was below the maxima for such periods.[3] The deviations of the items of each series from the base lines (or lines of secular trend) were expressed in comparable units, i. e., the standard deviation found for the pre-war period. By use of the statistical devices just described it was possible to bring the three curves for speculation, business, and banking together for comparison. In interpreting the Index Chart thus constructed the position of each curve with respect to the base line is of little significance; rather, in analyzing the present and forecasting the future, (1) the direction of movement of each curve considered in connection with the direction of movement of the other curves, (2) the direction of the immediately preceding movements, and (3) the magnitude of such movements are of primary significance.

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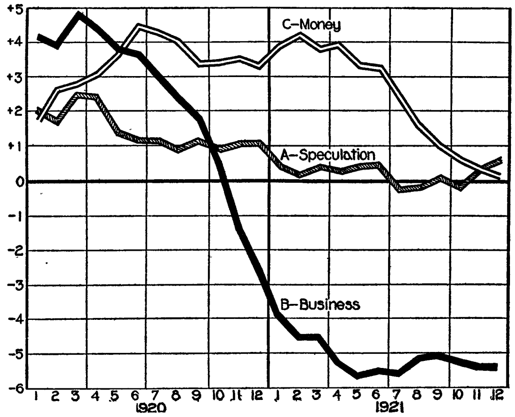
[1] Only 18 series appear in the averages for the 5 groups. Railroad gross earnings and reserves of the New York banks were excluded in finding the average for Group IV because it was desired to limit that group to commodity prices.

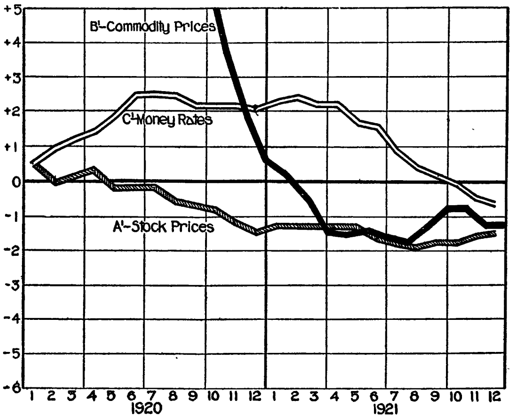
[2] See the chart on page 110 of the REVIEW for April, 1919. The same relationship clearly holds for pig-iron production and pig-iron prices (see Chart VII on page 382 of the REVIEW for December, 1921).

Chart 1*a*



The Index Chart based upon (A) the average of New York City bank clearings, shares traded on the New York Stock Exchange and the Dow-Jones index of the price of industrial stocks, (B) the average of bank clearings outside New York City and Bradstreet's price indices, and (C) the average of rates on 60–90 day and 4–6 months commercial paper: monthly, 1920–21.

Chart 1*b*



A Supplementary Index Chart based upon the Review's (A') price index of 20 industrial common stocks, (B') wholesale price index of ten important commodities, and (C') the average of rates on 60–90 day and 4–6 months commercial paper: monthly, 1920–21. (The base line for each curve has been determined with reference to the turning points of 1921.)

Chart 1*b* is a Supplementary Index Chart based upon industrial stock prices, commodity prices, and money rates. The lines of secular trend, or base lines, for all three curves are assumed to be horizontal for 1920–21; moreover, the base lines were all determined with reference to the turning points reached in the depression of 1921. The base line for stock prices, for instance, was determined with reference to the minimum of August 1921, the base line being above the trough by the maximum pre-war interval. A like method was used to determine the base lines for commodity prices and money rates.[4]

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[3] See the *Supplement* to the Review, June, 1919, p. 10.

[4] The method used is the following: *Curve A'*. An examination of our index number for the prices of 20 industrial stocks over the period 1902–14 shows that the maximum percentage rise from a trough to a subsequent peak was 156 per cent, and that this rise took place between November 1907, when the index stood at 52.7, and November 1909, when it reached 135.0. For the post-war period the stock price index shows a low point of 121 in August 1921. If from this low point there should be an increase equal to the maximum pre-war percentage rise — that is, 156 per cent — the index would reach a maximum of 310. The base line has been assumed to be midway between 121 and 310 — that is, at 215.5.

Curve B'. The method of determining the base line for 1920–21 is the same as that just described for curve A'. The maximum percentage from trough to peak during 1902–14 was 48 per cent, and occurred between September 1904, when the index stood at 106.7, and March 1907, when it stood at 157.5 (in terms of the base, average for 1890–99 = 100). The post-war index shows a low point of 107 in August 1921. If from this low point there should be a rise equal to the pre-war maximum percentage increase, the price index would reach 158. The base line has been taken midway between 107 and 158, or at 132.5 (the post-war indices are expressed in terms of the base, average for 1913 = 100).

Curve C'. In 1921 both security and commodity prices reached the end of their downward movements and began to

As has been said, the base lines of the two charts result from different assumptions; in addition the corrections for seasonal variation of the money curves also differ, the correction for seasonal variation in curve C′ is just one-half that in curve C. Curve C′ for money rates in Chart 1*b*, however, is based upon precisely the same statistical series as curve C in Chart 1*a*, the only difference in the two being the method of adjusting or correcting the original figures. The indices of seasonal variation used in correcting curve C were obtained from an analysis of pre-war data covering a period of about 25 years. It is probable that under the federal reserve system seasonal variations in money rates have been very much reduced and for this reason the seasonal corrections for curve C′ for 1920–21 have been reduced to one-half of those used in correcting curve C of Chart 1*a*.

The picture of the business situation of 1920–21 as given by Chart 1*b* is quite consistent with that given by Chart 1*a*. The decline of stock prices which began in November 1919 and which continued, with minor interruptions, through December 1920, was followed by a sidewise movement during the first five months of 1921, a decline to the minimum monthly average in August, and a gradual rise for the remainder of the year. The precipitate fall of commodity prices, curve B′, which began in the spring of 1920, was terminated on April 1, 1921. From April 1 to August 1 commodity prices moved sidewise and since the latter date there has been a slight recovery. Money rates rose to a high point in June 1920 and remained on a relatively high level for eleven months. Since April 1921 curve C′ (and curve C as well) has declined without interruption.

Examination of the supplementary index chart based on prices and money rates lead us, therefore, to the same conclusion as that derived from the current Index Chart. That is, Charts 1*a* and 1*b* both show that during the last half of 1921 the business situation has been slowly but surely improving.

THE PERIOD 1902–14

Curve B′ of Chart 1*b* is based upon the ten-commodity price index of business cycles described in the REVIEW for December, 1921. The index is an average of the prices of "commodities which are varied in nature, important in industry, unusually sensitive in price, not greatly affected by the seasons, and similar with respect to their main cyclical price movements." The commodities are: cottonseed oil, coke, pig zinc, pig iron, bar iron, mess pork, hides, print cloths, sheetings, and worsted yarns.

The trends over a period of years of the prices of the ten commodities utilized in the index are, of course, widely different. For the pre-war period 1898–1914 the prices of mess pork, cottonseed oil, and hides moved upward more rapidly than other commodities of the group while bar iron, coke, and pig iron actually declined somewhat. The secular trends of the prices of the ten commodities during the period named are shown by the sheaf of lines in Chart 2. It is obvious that to isolate the cyclical movements of each price series from the long-time trend, deviations from the line of secular trend of each series must be taken. If we find the percentages that the actual prices of each commodity bear to corresponding ordinates of linear trend, take the arithmetic averages of such percentages for the ten commodities, and plot the resulting averages, we will have curve A of Chart 3.[5] On the same chart for comparison with curve A, is given curve B which is obtained by a shorter and less accurate method, that is by finding the single line of secular trend for the ten-

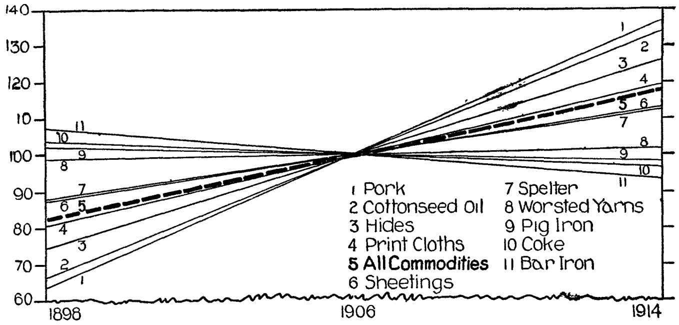
rise, but in January 1922 commercial paper rates are still falling. Consequently, instead of determining for this series the maximum pre-war *rise*, as was done in the case of security and commodity prices, the maximum pre-war *drop* was measured. It was found that for the period 1902–14 the rate on 60–90 day paper showed its largest decline, from 8 per cent to 3¼ per cent, between December 1907 and June 1909. It happens that the maximum rate for the post-war period, reached in August and October 1921, was also 8 per cent. If from this latter high point the rate should show a decrease equal to the largest pre-war decline, it would once more stand at 3¼ per cent. The base line has been set at 5½ per cent, approximately midway between 8 per cent and 3¼ per cent.

During 1920–21 the rate on 4–6 months paper has been, on the average, about ¼ per cent higher than that for 60–90 day paper. Consequently the trend for the former series has been set ¼ per cent higher than that for the latter, or at 5¾ per cent.

[5] The monthly averages for the period 1898–1914 are given in the REVIEW for December, 1921, p. 383, Table IV. Only one of the commodities, hides, had a marked seasonal variation. This series was corrected by use of the following indices of seasonal variation, relative to the average for the year as 100: January, 101.5; February, 98.8; March, 95.0; April, 92.4; May, 94.9; June, 96.6; July, 98.3; August, 101.9; September, 103.8; October, 106.0; November, 105.8; December, 105.0. The method of computing these indices is explained in the REVIEW for January, 1919.

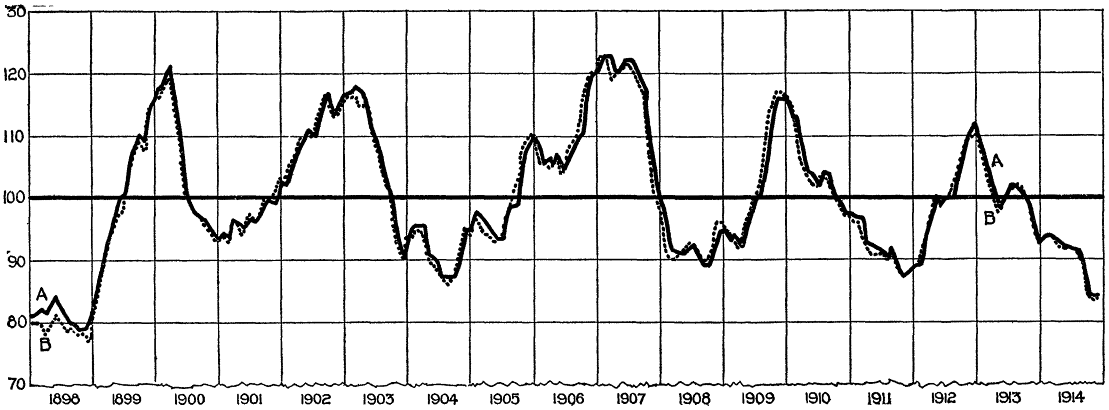
commodity index and expressing the index as a percentage of the corresponding ordinate of trend. The correspondence of the two curves is exceedingly close and either one satisfactorily shows the cyclical fluctuations of commodity prices during the period covered.

CHART 2



The lines of secular trend of ten series of commodity prices and of the index of the Bureau of Labor Statistics for all commodities, 1898–1914.

CHART 3



Comparison of (A) the arithmetic average of the percentages to the corresponding ordinates of their respective lines of secular trend of the prices of ten important commodities, with (B) the percentages to the corresponding ordinates of the line of secular trend of the ten-commodity price index of business cycles: monthly, 1898–1914.

Chart 4 presents the percentages found for the ten-commodity index, by the method just described, compared with similar percentages obtained for the REVIEW'S index of 20 industrial common stocks,[6] curve A, and the average rate on 60–90 day and 4–6 months commercial paper, curve C. The two series for rates on commercial paper, 1902–14, were adjusted for seasonal variation as determined by pre-war figures. The prices of hides, one constituent of the ten-commodity index, 1898–1914 and 1920–21, were similarly adjusted. Chart 4 brings out the fact that stock prices fluctuate more violently than do interest rates on commercial paper and that interest rates, in turn, fluctuate more violently than do average commodity prices.

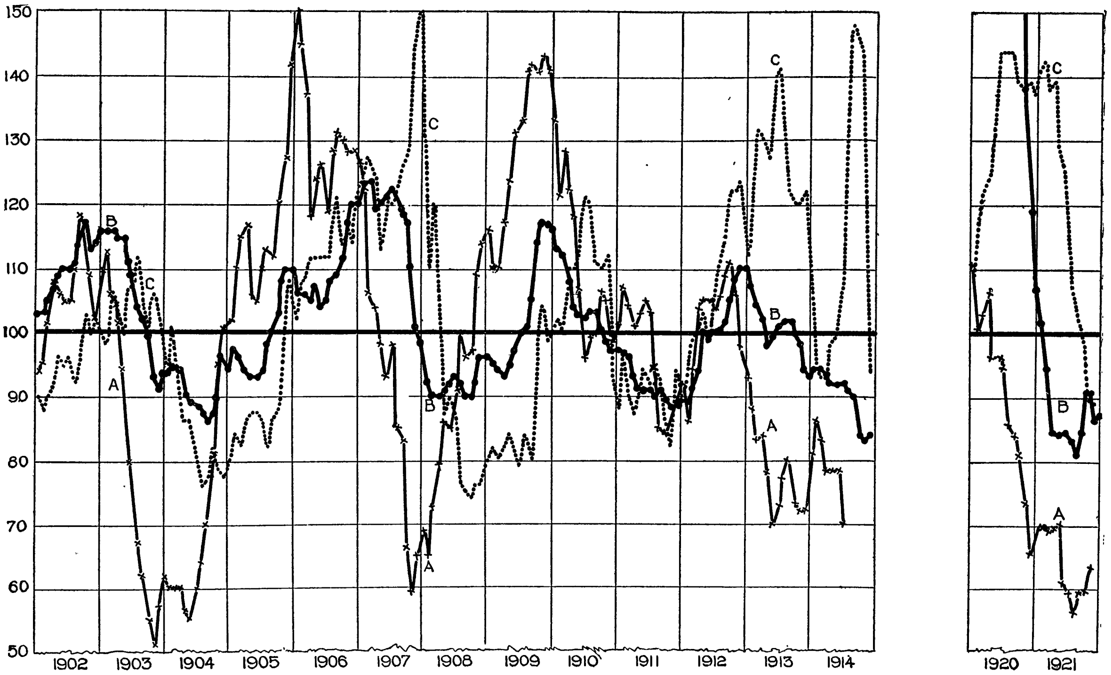
Chart 5 presents, with one change — each series is expressed in terms of its standard deviation[7] — the same three series given in Chart 4.

[6] See "An Index of Industrial Stock Prices" by Edwin Frickey in the REVIEW for August, 1921, pp. 264–277. The percentages of curve A were found by fitting a straight line to the index for the period 1902–13 and then dividing each item of the series by the corresponding ordinate of secular trend. In view of the close correspondence of the two curves of Chart 3 it was not thought necessary, in the case of stock prices, to go through the long process of averaging the percentages obtained for each constituent series.

[7] The standard deviations of the two price series are 22.7 for stock prices, 1902–13, and 10.8 for commodity prices, 1898–

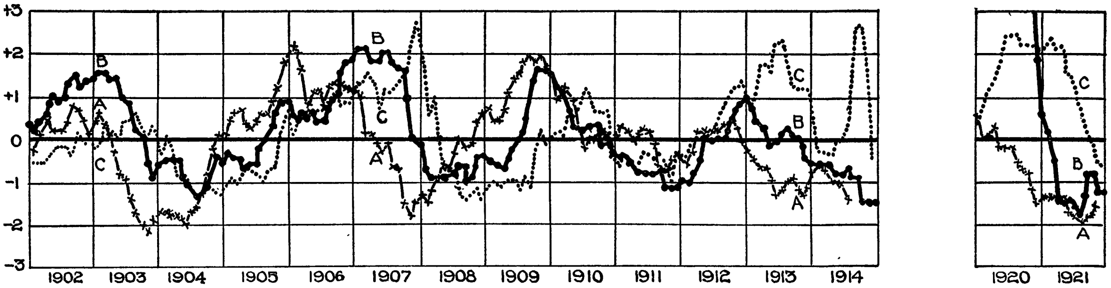
The result of this change is to emphasize the similarity of the cyclical fluctuations of the three curves. It is evident from this chart that the cyclical movements of stock prices are followed in point of time by similar movements of commodity prices, and these, in turn, by similar movements of money rates.

Chart 4



Percentages to the corresponding ordinates of their respective lines of secular trend of the Review's (A) price index of 20 industrial common stocks, (B) wholesale price index of ten important commodities, and (C) the average rate on 60–90 day and 4–6 months commercial paper adjusted for seasonal variation: monthly, 1902–14 and 1920–21.

Chart 5



Cycles (i. e., percentage deviations from lines of secular trend divided by the standard deviation) of the Review's (A) price index of 20 industrial common stocks, (B) wholesale price index of ten important commodities, and (C) the average rate on 60–90 day and 4–6 months commercial paper adjusted for seasonal variation: monthly, 1902–14 and 1920–21.

In the present article the relationship between stock prices, commodity prices, and money rates has been set forth for the periods 1902–14 and 1920–21. It will be the object of a later article to compare fluctuations in prices of securities, commodities, and credit with fluctuations in the volume of securities traded, commodities produced, and credit granted.

1914. The standard deviations for the rates on 60–90 day and 4–6 months commercial paper are, respectively, 19.66 and 16.46 for the period 1903–16. The figures for curve C of chart 5, monthly 1903–14 and 1918–April 1921, are given in the Review for May, 1921, p. 114. The figures for the other curves have not been published.